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A Bibliometric Analysis of the Use of Augmented Reality in Ethnomathematics Education

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Abstract

One area that has been gaining increasing attention is the integration of Augmented Reality (AR) technologies in mathematics education, especially within the context of ethnomathematics. This study aims to explore trends, developments, and directions of research related to the use of Augmented Reality (AR) technology in ethnomathematics education through a bibliometric approach. By utilizing the Scopus database, relevant scientific articles were selected based on keywords such as "augmented reality", "ethnomathematics", and "education" from the Google Scholar database between 2015 and 2025. Publish or perish software was used to collect data while the Vosviwer application was applied to analyze the data. Using descriptive and bibliometric analysis, this study addresses two research problems as follows: a) the growth trajectory of studies related to the use of Augmented Reality (AR) technology in ethnomathematics; and b) mapping studies to identify the most important themes and topics. The results of the analysis show that the trajectory of studies related to the use of Augmented Reality (AR) technology in ethnomathematics. Several topics that are rarely studied are recommended to be basic ideas in further research. These findings contribute not only to mathematics education researchers but also to other stakeholders, including education policy makers.

Keywords: *Augmented Reality, Bibliometrics, Ethnomathematics, Google Scholar, Publish or Perish*

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INTRODUCTION

The rapid advancement of digital technology has brought significant changes to the field of education, particularly in the innovation of mathematics teaching and learning. One area that has been gaining increasing attention is the integration of Augmented Reality (AR) technologies in mathematics education (Astarina et al., 2023; Dini Rahmawati et al., 2022; Mursyidah & Saputra, 2022), especially within the context of ethnomathematics. Ethnomathematics is the study of how mathematical concepts develop and are applied within local cultural contexts (Dewi et al., 2023), making learning more contextual (Hidayati & Prahmana, 2022), meaningful (Afriliziana & Roza, 2021), and relevant for students (Aprilia et al., 2019; Fouze & Amit, 2021; Mayasari et al., 2020).

The integration of AR in ethnomathematics offers new opportunities to connect mathematical concepts with local cultural practices in a more tangible and interactive manner (Dini Rahmawati et al., 2022). For example, AR technology enables the visualization of cultural objects in three-dimensional forms that students can manipulate directly, thereby helping them to better understand the mathematical concepts embedded in these cultural artifacts. In addition to enhancing motivation and the learning experience, the use of AR-based media has been shown to improve students' creative thinking skills, learning outcomes, and numeracy. (Astarina et al., 2023).

Despite the significant potential of integrating AR with ethnomathematics, research specifically addressing the use of these technologies in ethnomathematics education remains limited. Preliminary studies indicate that the development of AR-based learning media within ethnomathematical contexts is valid and feasible for use in mathematics instruction, particularly in topics such as geometry and proportional reasoning. However, a comprehensive review of trends, collaborations, and research developments in this area is still needed.

In this context, bibliometric analysis serves as a relevant method to map the development of research, identify publication trends, and uncover research gaps related to the use of AR in ethnomathematics education. Through bibliometric analysis, it is possible to determine how this topic has evolved globally, identify the researchers and institutions contributing to it, and assess which research topics have received the most attention.

Therefore, this article aims to conduct a bibliometric analysis of the use of Augmented Reality in ethnomathematics education. The findings of this study are expected to provide a comprehensive overview of the research landscape, trends, and future opportunities for the development of culturally and technologically innovative mathematics education.

METHOD

This study uses a bibliometric analysis method. The bibliometric analysis method is a branch of science that studies the statistics of information literature that can be used as an evaluation tool and the results of the analysis produced through mathematical research (Giraldo et al., 2019). Bibliometrics can also be interpreted as a study that measures the development of research, literature, books or documents in a particular field either quantitatively or qualitatively using

statistical methods (Hakim, 2020). The bibliometric analysis used is a descriptive bibliometric analysis that aims to study or evaluate a mathematics learning media. The bibliometric method is applied for various benefits, including explaining new things found in articles and journals.

This study analyzed 75 Google Scholar indexed documents between 2015 - 2025 which specifically examined the Use of Augmented Reality in Ethnomathematics Education. This work was carried out to answer the research questions that were previously described above. In bibliometric analysis, keyword co-occurrence recording shows the most common keywords that appear in the analyzed documents (Phan et al., 2021) to conclude that certain documents have the same topic and are related if they share some keywords specified in the keywords section.

In this study, the Google Scholar database was chosen as a place to search for documents because Google Scholar applies consistent standards in selecting documents to be included in its index. In addition, Google Scholar displays more documents than other top databases such as Web of Science, especially for research reviews in the fields of education and social sciences (Hallinger & Chatpinyakoop, 2019; Hallinger & Nguyen, 2020). Given these important reasons, Google Scholar is used in this study. In this study, we use the Publish or Perish application to collect data related to the Analysis from the Google Scholar database. Figure 1 shows the process of searching the Google Scholar database using the POP application.

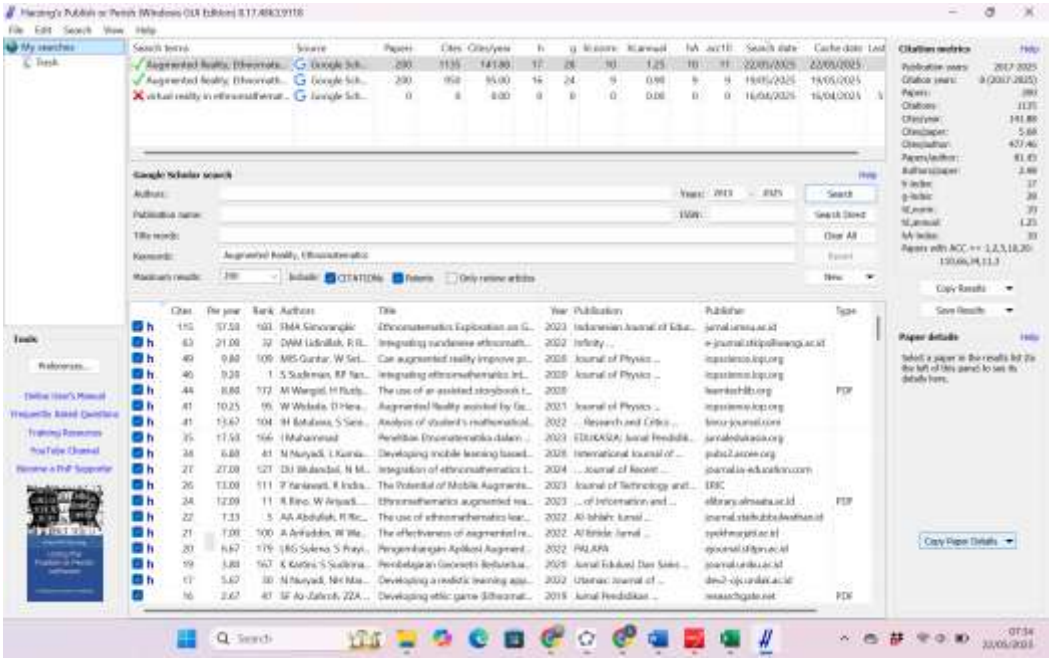

Figure 1. Bibliometric Tracing Analysis from Google Scholar Database Using PoP

Figure 1 is the initial procedure in collecting the Google Scholar database using PoP before screening. Furthermore, to filter the data collected through PoP, this study follows the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines (see Figure 2). In the identification step, the search was carried out using the keyword "Augmented Reality, Ethnomatematics Education", and the year of publication was "2015 - 2025".

Furthermore, from the results of data identification through PoP, 200 articles were collected, which were the population of this study, and were then filtered in the second step. In the screening step, the inclusion criteria set were: a) document type: Article; b) language: Indonesian; c) subject area: not limited to Indonesia; and d) year of publication: between 2015-2025. In this step, 26 documents were removed because they were in the form of books, theses, and papers. Thus, 184 documents were continued to the third step (eligibility). In the third step, we investigated each document by reading its title and abstract. Each member was given the task of reading and making recommendations to keep or exclude the document. At the end of this step, all members discussed the reasons for removing a particular document from the analysis data.

The research group re-investigated the title, abstract, and sometimes the full-text article to determine whether or not the article should be rejected. In this step, 14 documents were removed because their content was not relevant to this analysis. The final dataset that was eligible for analysis in this bibliometrics consisted of 75 documents, all of which were stored in a Mendeley file for further bibliometric analysis. The application that assisted the analysis was the VOSviewer software. This application was used to create a mapping network between topics so as to find trends in Google Scholar data-based studies on bibliometric analysis on the Use of Augmented Reality in Ethnomathematics Education, according to keywords.

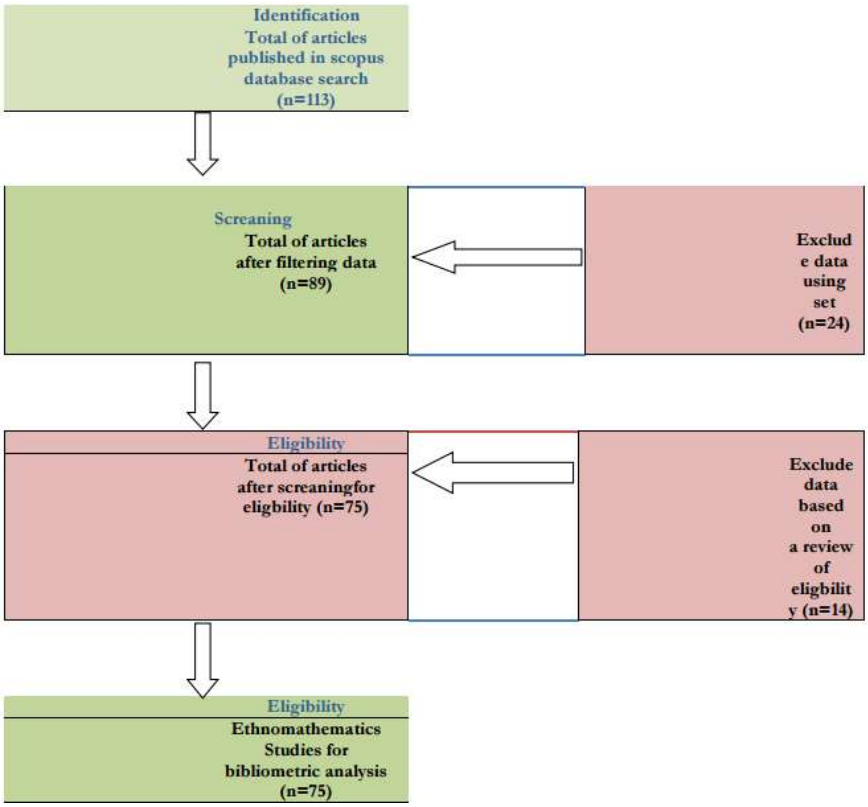

Figure 2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

RESULT AND DISCUSSION

This study analyzed 75 Google Scholar indexed documents between 2015 – 2025 that specifically examined the Use of Augmented Reality in Ethnomathematics Education. The work was carried out to answer the following research questions, "what is the form of study mapping to identify the most important topics and topics?" Therefore, this study aims to analyzed the problems raised. Based on the analysis of the results using the VOSviewer program, the results were obtained as will be described in the following explanation.

Result

The search results using PoP also show that the total number of citations of articles related to the Use of Augmented Reality in Ethnomathematics Education is 264 out of 75 eligible articles from 2015-2025. The articles with the largest number of citations are presented in Table 1 below.

Table 1. Top Authors by Number of Citations between 2015 and 2025

Number of Citations	Author	Article Title	Year	Name Journal
63	Gustina, D. M., Mariana, N., & Wiryanto, W.	Augmented Reality-Based Ethnomathematics Learning Media to Enhance Spatial Ability in 3D Geometry for Fifth Grade Elementary Students	2025	*Journal of Innovation and Research in PrimaryEducation*,
46	Pramulia, P., Yustitia, V., Kusmaharti, D., Fanny, A. M., & Oktavia, I. A.	Ethnomathematics of Al Akbar Mosque Surabaya: Augmented reality comics to improve elementary school students' literacy and numeracy	2024	*Multidisciplinary Science Journal*
41	Umri, BK, Rahman, AZ, & Aini, AN	Pengembangan Media Pembelajaran Etnomatematika Candi Prambanan Berbasis Augmented Reality untuk Materi Geometri.	2025	*Jurnal Teknologi Informasi Dan Ilmu Komputer*

Number of Citations	Author	Article Title	Year	Name Journal
34	Kamid, K, & Anwar, K	E-Magazine-Education Etnomatematika Batik Jambi Berbasis Teknologi Augmented Reality untuk Meningkatkan Hasil Belajar Matematika Siswa	2025	Aksioma: Jurnal Pendidikan Matematika
31	Jampel, IN, & Antara, IGWS,	Ethnomathematics-Collaborative Augmented Reality: An Innovative Framework to Enhance Problem-Solving Skills in Elementary Geometry	2024	Jurnal Ilmiah Sekolah Dasar
27	Salsabila, NH, Wulandari, NP	Ethnomathematics Learning Media Based on Augmented Reality in Geometry to Improve Numeracy Skills	2024	Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam
21	Rohim, DC, Hana, FM, &	Augmented Reality Learning Media with Ethnomathematic Approach to Grow Students' Mathematics Learning Motivation	2024	JTAM (Jurnal Teori dan Aplikasi Matematika)
18	Ira Ika Damayanti, Annisa Ayu, Umi Indah Sariah, Mustaqfiroh Mustaqfiroh, Intan Ayu Oktaviani,	Development of Curved Three-Dimensional Shape Learning Media Ethnomathematics-Based Using Augmented Reality	2024	Jurnal Kreano

Number of Citations	Author	Article Title	Year	Name Journal
	Farida Nursyahidah			
15	Sartika Sari Dewi, Andi Muhammad Irfan Taufan Asfan, Andi Muhamad Iqbal Akbar Asfar, Andi Nurannisa, Wiwi Damayanti, Nining Wahyun	Enhancing Students' Logical Thinking through Ethnomathematics-based Augmented Reality of Bola Soba Character Facades	2024	Journal of Innovation in Educational and Cultural Research
13	Ni Luh Puspa Pratiwi, I Made Suarjana, Basilius Werang	Upakara Bali Ethnomathematics Monopoly Media Based on Augmented Reality on Geometry Material	2024	Jurnal Media dan Teknologi Pendidikan

Table 1 represents the top studies related to the Use of Augmented Reality in Ethnomathematics Education in terms of the number of citations. It can be seen that the top citation ranking is Gustina, D. M., Mariana, N., & Wiryanto, W. with 63 citations, followed by Pramulia, P., Yustitia, V., Kusmaharti, D., Fanny, A. M., & Oktavia, I. A. with 46 citations, NR Dewi, and Umri, BK, Rahman, AZ, & Aini, AN with 41 citations.

How is the Mapping, Gap and Density of Studies Related to the Use of Augmented Reality in Ethnomathematics Education? The second objective of this study is to answer questions related to the mapping of gaps and density of studies on the Use of Augmented Reality in Ethnomathematics Education. From the results of the analysis, the mapping results were obtained (see Figure 3), novelty analysis (Figure 4), and also density analysis (Figure 5). The results section should provide a comprehensive description of the key findings, accompanied by empirical evidence, including but not limited to interview transcripts, written artifacts, excerpts, and other pertinent data.

Based on Figure 3, the topic of the Use of Augmented Reality in Ethnomathematics Education is quite varied. This can be seen in the four colors representing six theme clusters. The

red color represents cluster one and contains 10 items where the most frequently appearing are virtual reality, education, knowledge, era, user, integration. The green color consists of 6 items representing cluster two including reality technology, PBL model, influence, geogebra, teacher. Furthermore, the light blue color consists of 5 items representing cluster three, the items include elementary school student, http, org. Furthermore, the dark blue color consists of 7 items representing cluster four, the items include augmented reality medium, understanding, mathematics education. Furthermore, the purple color consists of 7 items representing cluster five consisting of ethnomathematics approach, game, systematic review, creative thinking skill, android and challenge. Furthermore, the light blue color consists of 8 items representing cluster six consisting of augmented reality medium, understanding, mathematics education. Next, the dark yellow color consists of six items, namely ethnomathematics research, and researcher. While the light yellow color consists of 8 items representing cluster seven, namely culture, model, effort, and assessment.

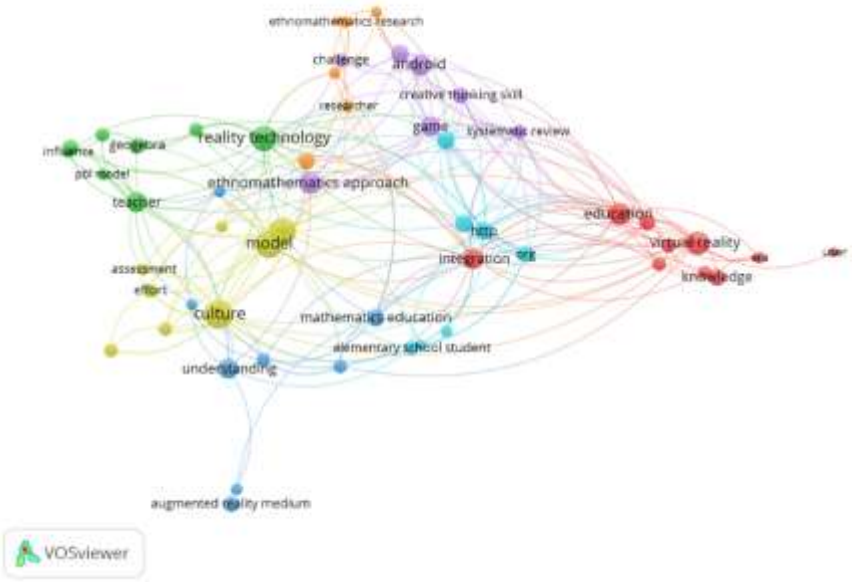

Figure 3. Results of Network Visualization Analysis of the Use of Augmented Reality in Ethnomathematics Education

Figure 4 illustrates the Frames Overlay Visualization Study, the Use of Augmented Reality in Ethnomathematics Education, to obtain a clear picture of the trend of article writing themes in journals taken from the Google Scholar database. When Figure 4 is observed, it appears that the trend of research themes related to the Use of Augmented Reality in Ethnomathematics Education from 2015 to 2025 is marked by the yellow, blue, and dark green themes. This means that the themes of "ethnomathematics research", "creative thinking skills", "systematic review", "reality technology", "PBL models', "virtual reality" and "understanding" are the latest themes related to the Use of Augmented Reality in Ethnomathematics Education.

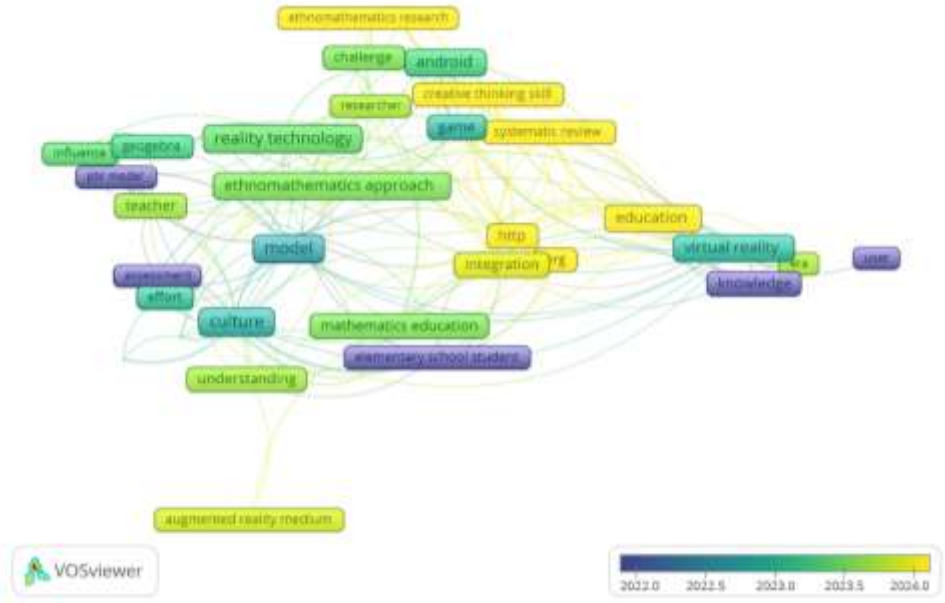

Figure 4. Frames Overlay Visualization Study on the Use of Augmented Reality in Ethnomathematics Education

Furthermore, based on the results of observations and data processing by researchers, it was found that density visualization shows the density of the theme being studied. The density of the study theme is indicated by the bright yellow color. The brighter the theme color indicates that more research has been done on the theme. The dimmer the color means that the theme is still rarely studied. It can be seen that the themes that often appear are "model", "culture", "android", "game", "virtual reality", "reality technology" and "integration". While the themes that are dimly colored such as "geogebra" "PBL model", "understanding" "augmented reality medium" are themes that can be used as references for further research. This is as seen in the illustration of Figure 5.

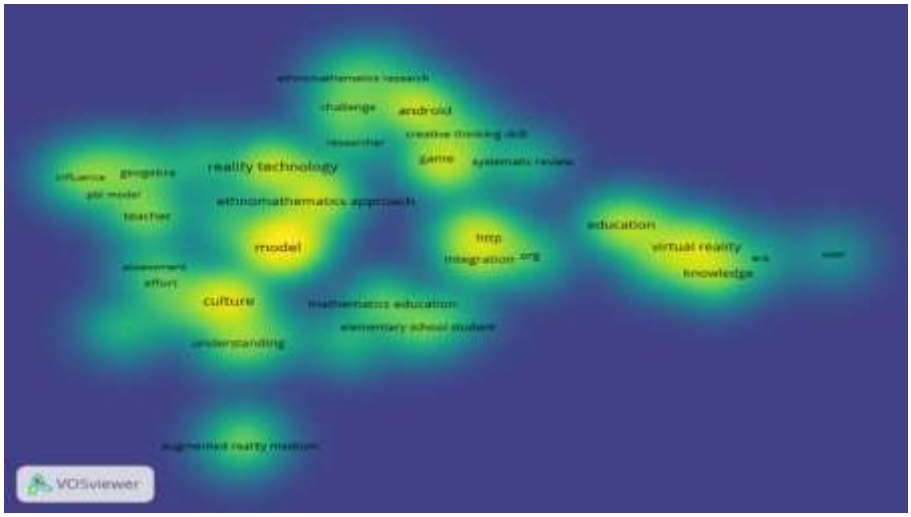

Figure 5. Visualization of Study Density on Use of Augmented Reality in Ethnomathematics Education

The Use of Augmented Reality in Ethnomathematics Education in terms of the number of citations. It can be seen that the top citation ranking is (Gustina, et.al, 2025) with 63 citations, followed by (Pramulia, et.al, 2024), with 46 citations, (Dewi, et.al, 2024) with 41 citations.

CONCLUSIONS

This study was conducted to obtain a comprehensive picture of the use of Augmented Reality (AR) technology in ethnomathematics education. This objective was achieved by conducting a bibliometric analysis. The findings of the study analyzed 75 primary studies between 2015-2025 show the trend of using Augmented Reality (AR) technology in ethnomathematics education.

The growth trajectory of related studies related to the use of Augmented Reality (AR) technology in ethnomathematics is influenced by social restrictions, especially in the school environment, and technological developments. The results of the analysis also show that topics that are rarely studied related to the influence of the use of Augmented Reality (AR) technology in students' ethnomathematics are discovery, optimization problems, and technomathematical fluency. This gap will be the basic idea for further studies on the use of Augmented Reality (AR) technology in ethnomathematics.

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